Space Weather Technical Forecast

Issued on Thursday, 04 April 2024 at 01:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Solar activity Low or Very Low. Chance of G1 Minor Storm intervals Day 1 (04 Apr), declining Day 2 (05 Apr) due to coronal hole fast winds. Chance of Active fluence by Day 4 (07 Apr).

Analysis of Space Weather Activity over past 24 hour
Solar Activity: Activity has been Very Low with no significant solar flares. There are currently four small and simple sunspot regions on the disc, none of which show any magnetic complexity at present.
No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE and DSCOVR at L1, showed waning fast wind conditions, now most likely from CH13/+. Solar wind speeds were initially slightly elevated, easing to ambient during the period and are now near 350km/s. Density was average or below. Total Interplanetary Magnetic Field (IMF), Bt, was weak below 7nT but with a slight increasing trend. The north-south component, Bz, varied weakly between +/-5nT. Phi angle remained mostly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES-18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels. The associated 24-hour fluence remained well below Active, with a value of 3.11e6 integrated pfu at 04/0000UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: Low to Very Low activity is expected, with a slight chance of isolated M-flares given the unknown risk from over the east limb, with this increasing slightly through the period.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently expected. Solar wind speeds at L1 have returned to ambient levels after the recent weak High Speed Stream (HSS) influence, most likely from CH13/+. The onset of a likely stronger HSS from CH16/- and CH17/- is expected during Day 1 (04 Apr). Ongoing HSS effects are then expected into Day 2 (05 Apr), before gradually easing towards background levels by the end of the period.
Geomagnetic activity is forecast to be initially Quiet on Day 1 but increasing to become generally Unsettled to Active with a chance of G1/Minor Storm intervals due to the HSS onset, with activity then decreasing during Day 2 to become largely Quiet to Unsettled by Day 3 (06 Apr).

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES18, is expected to remain near background levels. High energy electron flux is expected to persist at background levels initially, potentially rising after the next HSS enhancement. There is a chance of fluence rising above the Active (1e8 integrated pfu) threshold by Day 4 (07 Apr).

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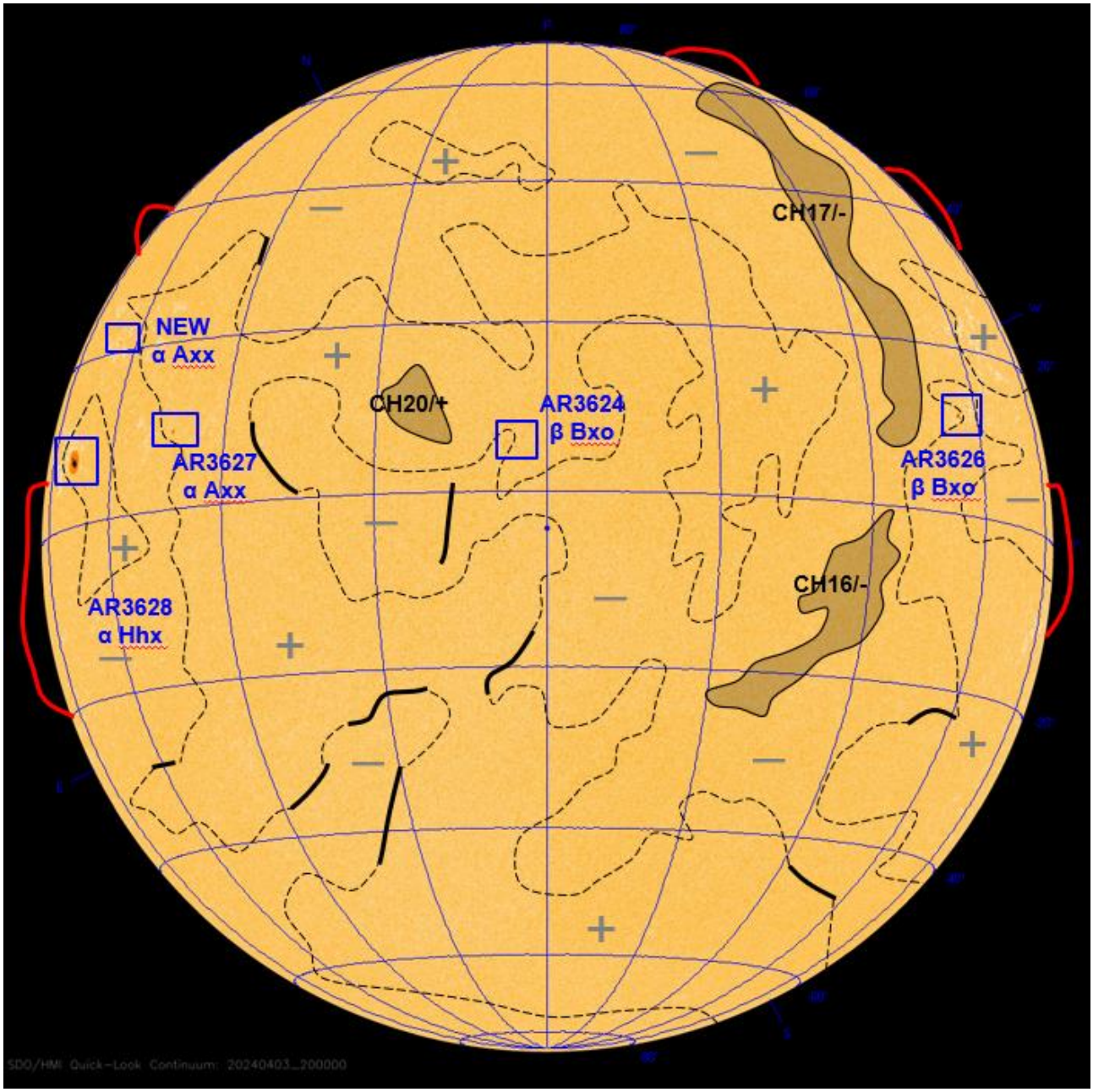
Figure 1. Solar Analysis Valid 03/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs currently expected.

Solar wind speeds at L1 have returned to ambient levels after the recent weak High Speed Stream (HSS) influence, most likely from positive polarity CH13/+. The onset of a likely stronger HSS from CH16/- and CH17/- is expected during Day 1 (04 Apr). These coronal holes are recurrent features, but much more prominent on this rotation. They are also more likely to give a geomagnetic response at this time of year than the recent (positive) fast wind due to their negative polarity. Enlil model output had been indicating an onset during Day 1, but recent model runs have moved this towards Day 2 (05 Apr). This is thought likely to be too late, with the onset during the first half of Day 1 more probable at this stage. Ongoing HSS effects are then expected into Day 2, before gradually easing towards background levels by the end of the period.

Geomagnetic activity is forecast to be initially Quiet on Day 1 but increasing to become generally Unsettled to Active with a chance of G1/Minor Storm intervals due to the HSS onset, with activity then decreasing during Day 2 to become largely Quiet to Unsettled by Day 3 (06 Apr).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	50	30	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs are currently expected.

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Figure 2a: SDO AIA-211 imagery from last rotation (left) and this rotation (right), with CH16/17 more prominent this time around.

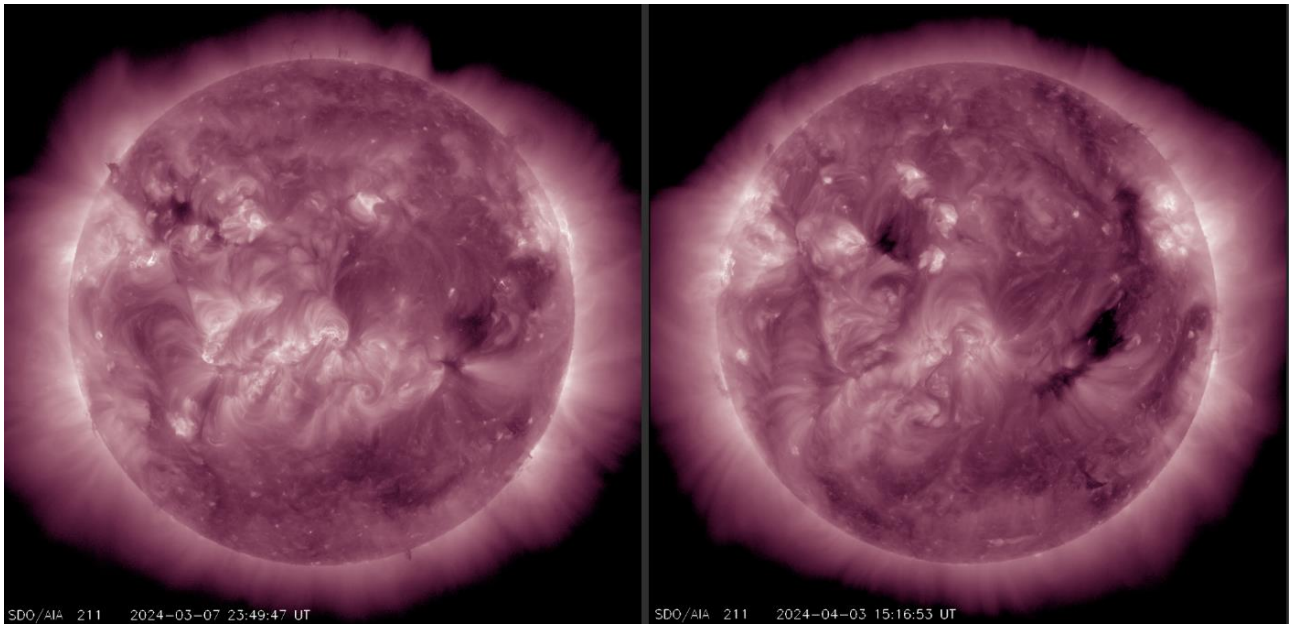
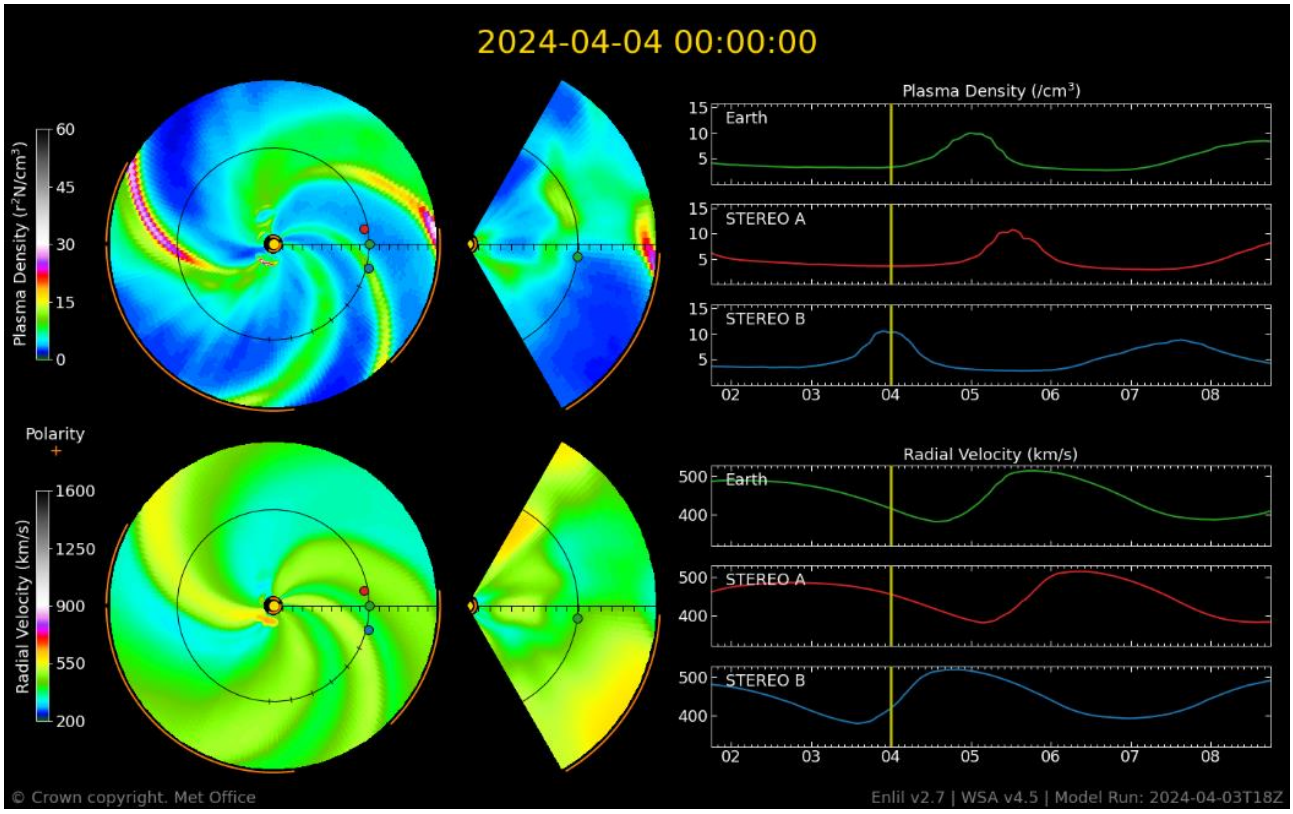


Figure 2b: MOSWOC Enlil showing a HSS onset into Day 2 (05 April), which may be a little late, with Day 1 (04 April) preferred.



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Radio Blackouts - X-Ray Flares:

The flare risk from the departed AR3615 has now cleared, with this region well over the limb. There are currently five small and simple sunspot regions on the disc, none of which show any magnetic complexity at the present time. There is the potential for returning regions to rotate onto the disc, although far side seismic monitors suggest no larger regions to rotate on until at least later in the period. There is no significant looping from over the east limb at the present time, suggesting the current Very Low or perhaps Low solar activity is likely to continue in the short term. A slight chance of isolated M-flares is maintained given the unknown risk from over the east limb, with this increasing slightly through the period mainly due to the increasing potential for regions to rotate over the east limb, plus the possibility of new regions developing on the Earth facing side of the disc.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	10	15	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux at GOES16 and 18, showing Very Low activity, with no C-class flares in the last 24 hours.

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Solar Radiation Storms - (High Energy Protons):
High energy proton flux observed by GOES-18 is now at background levels and expected to remain so, with none of the visible active regions currently expected to bring a risk of significant proton rich flares. Any new regions rotating onto the east limb may be more active but are expected to remain in the less favourable eastern hemisphere throughout the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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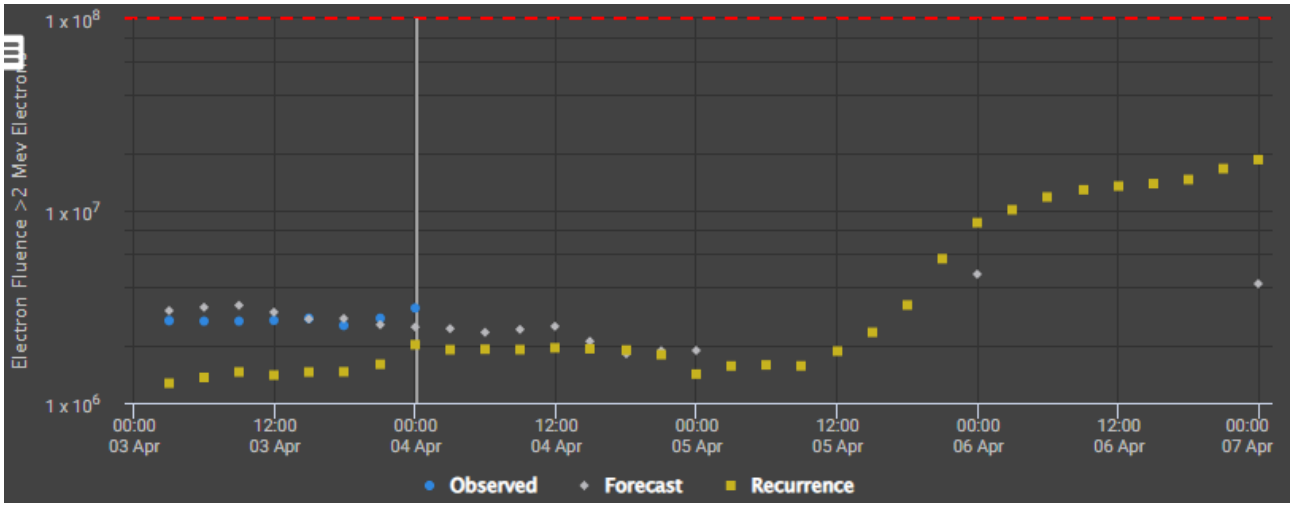
High Energy Electrons Event (≥ 2MeV):
GOES-16 high energy electron flux at GEO has persisted at background levels, with no significant enhancements expected until after the onset of any HSS from CH16/17. Electron flux may climb as a response to the faster wind speeds into Days 3 and 4 (06-07 Apr), potentially reaching High levels by the end of the period as coronal hole influence fades. As this HSS is now a little later than expected, any increase in electron flux is also expected to be slightly later than originally suggested.

The associated 24 hour fluence is expected to remain steady well below the Active (1e8 integrated pfu) level on Days 1-2 (04-05 Apr), before potentially rising through Days 3-4. This will bring a chance of reaching the Active threshold by the end of the period, although confidence is only moderate in any rise occurring. REFM is providing a good guide to current conditions, however the forecast later in the period remains unreliable until after any fast wind arrives at Earth and can be assimilated into the model.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	20	30
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing a below Active forecast (white dots) through the next three days. This may be too low by the end of the period, with a rise in fluence preferred.



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